



Application Serial No. 10/518,473
Attorney Docket No. 05788.0333-00000

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application. Please amend the claims, as follows:

1-21 (Canceled)

22. (Currently Amended) A bidirectional isolating device comprising at least a first non-reciprocal optical assembly, said assembly comprising:

at least a first polarizer;

at least a first non-reciprocal polarization rotator arranged for rotating a polarization of a signal of substantially $45^\circ \pm k \cdot 90^\circ$, wherein k is a non-negative integer;
and

at least a first wavelength selective reciprocal polarization rotator having a half-wave retarder behavior for a first group of optical frequencies and a full-wave retarder behavior for a second group of optical frequencies, according to a substantially frequency periodic transfer function;

said first wavelength selective reciprocal polarization rotator comprising a predetermined number of at least five birefringent elements having a predetermined thickness and orientation, ~~said number, thickness and orientation being adapted for obtaining so as to obtain~~ a transition between the half-wave retarder behavior and the full-wave retarder behavior in a frequency range lower than or equal to 40% of the period of said transfer function.

23. (Previously Presented) The bidirectional isolating device according to claim 22, wherein said optical assembly further comprises at least a first non-wavelength selective reciprocal polarization rotator, said polarizer, said non-reciprocal polarization rotator, said first non-wavelength selective reciprocal polarization rotator and said first wavelength selective reciprocal polarization rotator being arranged within said assembly so that a first optical signal having frequency in said first group of optical frequencies and a second optical signal having frequency in said second group of optical frequencies, input at said polarizer with whatever polarization, exit from said assembly so that the first optical signal is in a first polarization state and the second optical signal is in a second polarization state, orthogonal to said first polarization state.

24. (Currently Amended) The bidirectional isolating device according to claim 22, wherein ~~said number, thickness and orientation of said birefringent elements is adapted for obtaining~~ a transition between the half-wave retarder behavior and the full-wave retarder behavior is in a frequency range lower than or equal to 20% of the period of said transfer function.

25. (Previously Presented) The bidirectional isolating device according to claim 22, wherein at least all but one of said birefringent elements have substantially the same thickness.

26. (Previously Presented) The bidirectional isolating device according to claim 25, wherein said birefringent elements have all substantially the same thickness.

27. (Previously Presented) The bidirectional isolating device according to claim 25, wherein said birefringent elements having substantially the same thickness have a thickness variation of less than or equal to 1%.

28. (Previously Presented) The bidirectional isolating device according to claim 25, wherein said birefringent elements having substantially the same thickness are disposed so that elements having a lower thickness alternate to elements having a higher thickness.

29. (Previously Presented) The bidirectional isolating device according to claim 22, wherein said polarizer is adapted for splitting an optical signal having any polarization into two signal portions propagating onto two separate optical paths, with orthogonal polarizations.

30. (Previously Presented) The bidirectional isolating device according to claim 29, further comprising at least a second polarizer, adapted for coupling said two signal portions having orthogonal polarizations on a single optical path.

31. (Previously Presented) The bidirectional isolating device according to claim 23, further comprising at least a second optical assembly including a second polarizer, a second non-reciprocal polarization rotator, a second non-wavelength selective reciprocal polarization rotator, and a second wavelength selective reciprocal

polarization rotator having a half-wave behavior for a third group of frequencies and full-wave behavior for a fourth group of frequencies, said second polarizer, said second non-reciprocal polarization rotator, said second non-wavelength selective reciprocal polarization rotator and said second wavelength selective reciprocal polarization rotator being arranged within said second assembly so that a third optical signal having frequency in the third group of frequencies and a fourth optical signal having frequency in the fourth group of frequencies, input at said second polarizer with whatever polarization, exit from said second assembly so that the third optical signal is in a third polarization state and the fourth optical signal is in a fourth polarization state, orthogonal to said third polarization state, said first and second assemblies being optically coupled to a splitting component.

32. (Previously Presented) The bidirectional isolating device according to claim 31, wherein said first wavelength selective reciprocal polarization rotator has a transition between said full wave behavior and said half wave behavior at a first transition frequency, and said second wavelength selective reciprocal polarization rotator has a transition between said full wave behavior and said half wave behavior at a second transition frequency, different from said first transition frequency.

33. (Previously Presented) The bidirectional isolating device according to claim 31, comprising a first branch, a second branch, a third branch, and a fourth branch optically coupled to a splitting component,
said first branch including said first assembly;

said second branch including said second assembly;

said third branch including a third assembly comprising a third polarizer, a third reciprocal polarization rotator, and a third wavelength selective reciprocal polarization rotator; and

said fourth branch including a fourth assembly comprising a fourth polarizer, a fourth reciprocal polarization rotator, and a fourth wavelength selective reciprocal polarization rotator;

said first, second, third and fourth wavelength selective reciprocal polarization rotators all having a half-wave behavior for said first group of frequencies and a full-wave behavior for said second group of frequencies;

said third and said fourth assemblies being reciprocal and arranged such that said first optical signal and said second optical signal, input at said third or fourth polarizer with whatever polarization, exit from said third or fourth assembly so that the first optical signal is in a first polarization state and the second optical signal is in a second polarization state, orthogonal to said first polarization state.

34. (Previously Presented) The bidirectional isolating device according to claim 22, comprising a first branch, a second branch, a third branch, and a fourth branch optically coupled to a splitting component, wherein

said first branch is non-reciprocal and includes said first polarizer, said first non-reciprocal polarization rotator and a first non-wavelength selective reciprocal polarization rotator being arranged such that any optical signal, input at said first

polarizer with whatever polarization, exits from said first branch in a first polarization state;

 said second branch is non-reciprocal and includes a second polarizer, a second non-reciprocal polarization rotator and a second non-wavelength selective reciprocal polarization rotator being arranged such that any optical signal, input at said second polarizer with whatever polarization, exits from said second branch in a second polarization state, orthogonal to the first state;

 said third branch is reciprocal and includes said first wavelength selective reciprocal polarization rotator, a third non-wavelength selective reciprocal polarization rotator and a third polarizer being arranged such that a first optical signal having frequency in said first group of frequencies and a second optical signal having frequency in said second group of frequencies, input at said third polarizer with whatever polarization, exit from said third branch so as the first optical signal is in said first polarization state and the second optical signal is in said second polarization state; and

 said fourth branch is reciprocal and includes a second wavelength selective reciprocal polarization rotator, a fourth non-wavelength-selective reciprocal polarization rotator and a fourth polarizer, being arranged such that said first optical signal and said second optical signal, input at said fourth polarizer with whatever polarization, exit from said fourth branch so that the first optical signal is in said first polarization state and the second optical signal is in said second polarization state.

35. (Currently Amended) An optical amplifier comprising:

at least a first optical amplifying medium;

a pumping system suitable for generating a pumping power and for providing such pumping power to said first optical amplifying medium; and

a bidirectional isolating device comprising:

at least a first polarizer;

at least a first non-reciprocal polarization rotator arranged for rotating a polarization of a signal of substantially $45^\circ \pm k \cdot 90^\circ$, wherein k is a non-negative integer; and

at least a first wavelength selective reciprocal polarization rotator having a half-wave retarder behavior for a first group of optical frequencies and a full-wave retarder behavior for a second group of optical frequencies, according to a substantially frequency periodic transfer function;

said first wavelength selective reciprocal polarization rotator comprising a predetermined number of at least five birefringent elements having a predetermined thickness and orientation, ~~said number, thickness and orientation being adapted for obtaining so as to obtain~~ a transition between the half-wave retarder behavior and the full-wave retarder behavior in a frequency range lower than or equal to 40% of the period of said transfer function.

36. (Previously Presented) The optical amplifier according to claim 35, wherein said optical assembly further comprises at least a first non-wavelength selective reciprocal polarization rotator, said polarizer, said non-reciprocal polarization rotator, said first non-wavelength selective reciprocal polarization rotator and said first wavelength selective reciprocal polarization rotator being arranged within said assembly so that a first optical signal having frequency in said first group of optical frequencies and a second optical signal having frequency in said second group of optical frequencies, input at said polarizer with whatever polarization, exit from said assembly so that the first optical signal is in a first polarization state and the second optical signal is in a second polarization state, orthogonal to said first polarization state.

37. (Previously Presented) The optical amplifier according to claim 36, further comprising at least a second optical assembly including a second polarizer, a second non-reciprocal polarization rotator, a second non-wavelength selective reciprocal polarization rotator, and a second wavelength selective reciprocal polarization rotator having a half-wave behavior for a third group of frequencies and full-wave behavior for a fourth group of frequencies, said second polarizer, said second non-reciprocal polarization rotator, said second non-wavelength selective reciprocal polarization rotator and said second wavelength selective reciprocal polarization rotator being arranged within said second assembly so that a third optical signal having frequency in the third group of frequencies and a fourth optical signal having frequency in the fourth group of frequencies, input at said second polarizer with whatever polarization, exit from said second assembly so that the third optical signal is in a third

polarization state and the fourth optical signal is in a fourth polarization state, orthogonal to said third polarization state, said first and second assemblies being optically coupled to a splitting component.

38. (Previously Presented) The optical amplifier according to claim 35, further comprising at least a second optical amplifying medium, said pumping system being suitable for providing said pumping power also to said second amplifying medium, said bidirectional isolating device being disposed between said first and second amplifying medium.

39. (Previously Presented) The optical amplifier according to claim 38, wherein said first or second optical amplifying medium comprises a rare-earth doped fiber.

40. (Previously Presented) The optical amplifier according to claim 38, wherein said first or second optical amplifying medium comprises a Raman-active optical fiber.

41. (Previously Presented) The optical amplifier according to claim 38, wherein said optical amplifier is adapted for transmitting and amplifying an optical signal having frequency in said first group of frequencies in a first direction from a first Raman-active optical fiber to a second Raman-active optical fiber, said pumping system comprising at least one pump source adapted for providing a first pumping radiation

having frequency included in said second group of frequencies, said first pumping radiation being adapted for causing Raman amplification of said first group of signals at least in said second Raman-active optical fiber, said pumping system further comprising at least one coupler, one end of said second Raman-active optical fiber being optically connected to a first port of said coupler and said at least one pump source being optically connected to a second port of said coupler, so that said first pumping radiation may propagate in at least said second Raman-active optical fiber in a second direction, opposite to said first direction.

42. (Previously Presented) The optical amplifier according to claim 41, wherein said bidirectional isolating device is adapted for passing said first pumping radiation from said second Raman-active fiber to said first Raman-active fiber.

43. (Previously Presented) The optical amplifier according to claim 40, wherein

said pumping system comprises at least a second pump source adapted for providing a second pumping radiation having a frequency included in a third group of frequencies, said second pumping radiation being adapted for causing Raman amplification at least of said first group of signals in said first Raman-active optical; and

said bidirectional isolating device is adapted for coupling said second pumping radiation into said first Raman-active fiber in a second direction, opposite to said first direction.

44. (Previously Presented) The optical amplifier according to claim 43, wherein said bidirectional isolating device is further adapted for extracting a residual of said first pumping radiation coming out from said second Raman-active fiber.